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Diseases of the
Ear.

AN
INTRODUCTORY LECTURE,

AS DELIVERED 1816 AT THE

Royal Dispensary,

FOR

THE DISEASES OF THE EAR,

TO A

COURSE ON THE ANATOMY, PHYSIOLOGY,

KING'S COLLEGE HOSPITAL
AND

MEDICAL SCHOOL
DISEASES OF THAT ORGAN:

*Pointing out the great advantage arising from an exclusive attention
in Practice to one subject or class of Diseases, and the high impor-
tance attached to the Sense of Hearing, as the medium of social
intercourse, intelligence, and information.*

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KING'S *College* LONDON

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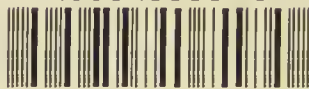
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P R E F A C E.

THE Author has been induced to publish the present Lecture, a part of which has already appeared in his work on the Physiology and Diseases of the Ear, to shew the plan he had adopted in his course, and the reasons for making a separate study of this branch; in order to render practitioners equally conversant in the treatment of the diseases of this intricate organ, as in other parts of the body. The reasons which support it will come home to the conviction of every one, and the success both of his public and private practice shews the just views he has adopted in prosecuting it.

LECTURE I.

THE profession of medicine, Gentlemen, is one of the first importance, whether considered merely as a science or department of knowledge, requiring and giving scope to the exercise of the greatest powers of the mind, or as a particular occupation involving the best interests of society:

It has accordingly, in every age, claimed the attention and gratitude of mankind, and its professors have been justly revered by all ranks, as the benefactors and guardians of the human race.

Like every other science, its early history was marked by mystery and concealment in those who cultivated it; but as civilization expanded the mind in other branches, and philosophy extended her reign, its principles came to be unfolded, and with this reformation its utility increased.

From the difference in the nature of disease, as it affects either internal organs, or attacks merely an external part, this science came to be soon divided into two principal branches of Physic and Surgery ; the former considered as the superior, and most scientific department, where the greatest knowledge and experience were required, and a full exercise of the powers of the mind to its successful practice ; the second regarded as less complex, by being within the reach of the eye, and demanding only an adroit use of the hand, and simple means for its application.

But in proportion as improvement opened new views to the cultivators of this science, and extended its subjects, these original distinctions came in part to be done away, and Surgery has of late years claimed an equality with the higher department of Medicine ; and its professors have attained a rank in society which in former ages they did not enjoy. Indeed the Surgeon stood, originally, in no better situation than as the servant of the Physician. Medicine, at that time, was chiefly practised by the ministers of religion ; and the sacerdotal character, not permitting the priesthood to have connexion with blood, the surgeon was called in as their attendant, to perform those operations, with which the sacredness of their functions did not allow them to interfere. The first improvement then, was the practice of

physic getting into the hands of the laity, and being exercised as a particular profession, such as it now is.

It is from this era its improvement began, and this distinction having once commenced, and being extended, the utility of the science has increased in a proportional degree.

This naturally arose from the observation of the intimate connexion of the diseases of a part with the whole system, and of the necessity for understanding the general feelings and energies of the whole machine, before a decision can be formed on the maladies of a *particular part*, and also of that apparent intimate relation which does not, in fact, allow their being disjoined.

One circumstance that retarded the progress of surgery for some time, was the cultivation of anatomy by the early physicians; as witness, the great and invaluable discovery of the immortal Harvey, in the circulation of the blood, which entirely changed the system of medicine at that time, the discoveries also of Glisson and others of the earlier physicians. The physicians presided at that period in the dissecting room, and of course took a lead in whatever regarded surgery, as well as medicine; but the increase of clinical practice to the physician, induced him, in time, to lay aside his attention to the dissecting room. As soon as that took place, it naturally fell into the hands of the surgeon.

to whom it was at last solely consigned. The moment the surgeon acquired this pre-eminence, by the field of anatomy being left to himself; that moment, what was hitherto regarded as little better than a manual art, expanded in its turn into an extensive branch of science, and admitted divisions equally numerous and varied, as those which had hitherto been confined to the department of medicine.

The consequence of this has been that surgeons, anxious to improve that part of the profession assigned them, have many of them, of late years, limited their practice to certain portions, or to the diseases of particular organs, a circumstance which has been of the highest utility to the interests of the community. Though, on this point, surgeons have chosen to be divided in opinion, it is more, perhaps, from self-interest, than from doubt of its utility; for every division clearly simplifies, and where a subject is extensive and complex, simplicity and perfection on any one point can never be obtained in any other way.

This minute division of surgery, first began with the diseases of the teeth, which certain individuals exclusively treated under the name of Dentists, and who form now a numerous and respectable body of practitioners.

It was next followed by others, in a similar exclusive attention to the diseases of the eye, under the name of Oculists, an organ which from its

nice structure and the delicacy and minuteness of its parts, requires both a skilful hand for the treatment of its diseases, and also an accurate and profound knowledge of its anatomy.

The perfection these branches have acquired, is the best proof how appropriately this division has been made, from which the greatest public benefit has accrued : for the advantage which has resulted to mankind from the exercise of the Oculist's profession, as a distinct branch, is incalculable : the operations on that delicate organ, the eye, are now conducted with a nicety and success unknown in former times : the formation of an artificial pupil, as first invented by Mr. Gibson of Manchester, and subsequently improved by the late Mr. Saunders, Sir William Adams, and others, has saved the sight of numbers, on whom former operations had failed, and who, without this discovery, must have continued in total darkness for life.

The same happy result to society has been the consequence of the profession of the Dentist. The teeth are essential to the appearance and symmetry of the visage ; without them that contour and harmony of features, which the face ought to possess, is wanting : but the teeth are parts of the body which nature has intended should more quickly decay than the other parts, from their greater exposure to external causes, acting upon,

and destroying their enamel, and osseous structure. When lost to the constitution, not only is the beauty of the countenance impaired, but the process of digestion becomes imperfectly carried on, the food is no longer comminuted as it ought to be, and stomach complaints, with a decay of general health, are too often the consequence.

The hand of the artist has here been the assistant of nature; the artificial substitutes are equal in their effect to the real organized productions originally implanted; nay, to such perfection has the art of man been carried, that in cases of certain complaints, where the palate or bony arch of the mouth has been destroyed, and the unhappy sufferer has been incapable of uttering and articulating, so nicely has mechanism supplied the defect, that no trace of it can be perceived, either in the articulation, or in the reception of food.*

These facts demonstrate clearly the advantage of subdividing the objects of professional pursuit

* This plan of subdividing its subjects has been long acted upon, also, in another liberal and scientific profession—the Law, with much advantage. The Counsellor who stands on the same footing as the Physician, often limits his practice to particular courts. The inferior departments are extensively branched out into numerous divisions, to give clearness, perfection, and despatch to the various and complex subjects, of which Law, as a branch of science, consists.

or study, and bending a close attention to one point; it is applying to medical science, that which experience has proved to be so successful, in the mechanical arts.

If we take, for example, the construction of a watch, there are no less than twelve different and distinct departments in its manufacture, and it is only by each department having but one wheel or other appendage to do, that this useful article is brought to its great exactness, perfection and cheapness; the same plan is extended to all the leading branches of manufacture in this country, of which our manufacturing towns afford the most striking examples; and it is a system, the utility of which has been strongly enforced and reasoned upon by the late celebrated Dr. Adam Smith, in his 'Wealth of Nations.' Indeed this subdivision and minute attention to one branch may be considered as the great safeguard of the manufactures of this country, perfection and cheapness are united by it in a most eminent degree, which will stand against the rivalry of any other nation, till the same extent of population is employed as in this country, and of course the same perseverance to *one object*; this is a fact which no reason can refute, and the principle of it is interwoven with our very nature.

The mind of man, it is clear, though capacious and possessed of very extensive powers, cannot

embrace the whole circle of science, or retain it with that exactness which is necessary to excel; he must select a part of the circle, if he wishes to shine, and must bend his attention to that subject alone, in scientific pursuits*. However, I do not intend, by this observation, to convey an idea, that the student should endeavour to get acquainted with the department he selects, only as a mechanical art, or that he should not travel beyond its bounds: on the contrary, a professional education should be so conducted, as to make every one first acquainted with the general principles and scope of every part of the profession; and this being once attained, and the general studies completed, *then*, and *not till then*, he should limit his pursuit to one subject; this subject, in consequence of his previous acquirements, he will then better understand; he will be able

* Such was the opinion of a celebrated relative of the author, the late Mr. William Curtis, who satisfied that no man can attend to two great objects at once, with equal success and improvement, gave up his medical pursuits for the study of Botany, in which he so eminently excelled; standing in so near a connexion to the author as uncle, he took an early interest in him which he feels a particular satisfaction in thus acknowledging. At his death, he left, as the successor to his botanical labours, Dr. John Sims, who has given the author his support and patronage in the line of practice he has selected, and is consulting physician to the Royal Dispensary for the Diseases of the Ear.

to improve it by a comparison and illustration of it with the other branches he has studied, and make them all bear on this favourite or leading topic: his previous acquirements may be thus considered in the light of scattered rays, which will be all brought home to this centre point or focus*.

The person who is wedded to one subject, acquires an intuitive knowledge from observation which cannot be conveyed by signs or even explained by words. It is like the amateur, who hearing a celebrated performer play on the violin,

* This has been the plan of the author, who after having gone through the preliminary branches of his profession with his father, an eminent practitioner in the country, removed to the metropolis; where after attending the different lectures on the various departments of the profession, he received his qualifications as a surgeon, from the Royal College of Surgeons in London, and was appointed a medical officer at the dépôt for prisoners of war at Stapleton, which at that time was very unhealthy. From Stapleton he was preferred to the Royal hospital at Haslar, where he continued nearly six years, during the most interesting part of the late war; first when the expedition returned from Walcheren, and afterwards when Sir John Moore's army landed from Corunna. The extent of the royal hospital at Haslar may be judged of, from 2,000 wounded being received into it from Lord Howe's fleet after the memorable engagement of the 1st of June, 1794. After leaving the public service in 1810, he resumed his studies, and since he has commenced practice, confined his sole attention to this particular branch of surgery.

wished to make a purchase of his instrument ; on purchasing it, however, he could not give it the same tones as its master, and when complaining to the latter of his cheating him, he archly replied, “ Ah, you forgot, you should have purchased my fingers too.”

I need hardly state to you, in estimating the different senses, the great importance of hearing, especially to man ; it is the grand medium which connects him with society, and that extends information and intelligence far beyond what the eye, or any of the other senses can do. Through this medium man is enabled to conduct the great and complicated business of life. By it his harangue is heard in the senate and his commands in the field. It forms the mutual and unembarrassed communication of all sentiment and expression.

The organs of voice, the most pre-eminent distinction of man, are even useless, unless their powers are excited through the agency of this sense ; and where hearing is defective in early life, dumbness is generally the consequence.

A remarkable instance of the leading influence of this sense, is recorded in the French memoirs, and quoted by the Count de Buffon ; where the want of hearing seemed even to prevent the very developement of the mind.

CASE.

“ A young man of the town of Chartes, about twenty-four, who had been deaf from his birth, began all at once to speak, to the astonishment of all who knew him.

“ He informed his friends, that for three or four months before he had heard the sound of bells ; and that he was extremely surprised at this new and unknown sensation.

“ Some time after, a kind of humour issued from his left ear, and then he heard distinctly with both. During these three or four months, he listened to every thing ; and without attempting to speak aloud, he accustomed himself to utter softly the words spoken by others. He laboured hard in acquiring the pronounciation of words, and in learning the ideas annexed to them. At length thinking himself qualified to break silence, he declared he could speak, though still imperfectly. Soon after he was interrogated by some able divines, concerning his former condition. The principal questions turned upon God, the soul, and moral good and evil ; but of these subjects he seemed to have not the *smallest* conception. Though he was born of catholic parents, attended mass, was instructed to make the sign of the cross, and to assume all the external marks of devotion, he comprehended nothing of their real intention. He had formed no distinct idea of death, and ex-

isted purely in an animal state : wholly occupied with sensible objects, and with the few ideas he had acquired by the eye, he drew no conclusions from them. He did not want parts; but the understanding of a man, when deprived of the intercourse of society, has so little exercise or cultivation, that he never thinks but when sensible objects obtrude themselves on his mind. The great source of human ideas arises from the reciprocal intercourse of society.”—Page 283, vol. 3.

Thus the defect of hearing appears to have locked up, as it were, the mental and rational powers; a strong proof of the necessity of the intercourse of society, to give the mind its information and proper feeling, and to rouse its different energies. The same thing is confirmed by the account given of a savage boy found in the woods of Ardennes, in France, who for want of this social intercourse, which can only take place through the influence of hearing, possessed neither the powers of language, nor any other feelings or ideas beyond those of other animals*. An account

* So successful has the author been in his practice, that he was induced to address the following letter to the Committee of Governors of the Asylum for the Deaf and Dumb, which received their thanks on the occasion. His object was that in addition to the consulting surgeon at present appointed to that establishment, there should be an attending surgeon or aurist, who should minutely examine every child offered for presentation, prior to their

of this case was published some years ago, by Dr. Reid, of the Royal College of Physicians.

In estimating the value of the different senses, the best criterion I conceive to go by, is the opinion

being admitted into the asylum, and report his opinion to the committee how far curable or otherwise.

Soho Square, Jan. 11, 1817.

Gentlemen,

IN presuming to address you on a subject which so materially interests the institution for the deaf and dumb, your patronage of which does you so much credit,

I beg leave to premise, that my object is not to interfere in the least with the present medical establishment; as I have the highest opinion of the professional talents, and deserved reputation of the medical officers you have been pleased to nominate; but these Gentlemen, I have no doubt, are too liberal in their sentiments, not to admit that the defect of being deaf and dumb, calls for an exclusive attention to these particular organs, greater than can be paid by any practitioner in general practice, however distinguished his abilities, or extensive his science, from wanting that particular experience which one exclusively confining himself to this department of surgery must possess.

In consequence of this, I beg leave most respectfully to suggest to your consideration, the advantage that would result to the institution, were an aurist appointed to attend, and minutely examine the particular defect in each child admitted into your establishment; by this means an opportunity would be given of trying such methods as appear best calculated to give relief; and by this plan, I conceive many of the objects of your laudable charity might probably be found curable, restored to society, and ren-

of such persons who have been partially deprived of them.

A blind man, who has been for years in that state, when desired to make a choice whether he would prefer the restoration of sight, on condition of the loss of hearing, has been heard to say that he considered himself happy, though blind, while he was able to converse with his friends.

Though this is in general the case, it is amazing in some instances of early blindness, to what perfection hearing has arrived, with a view to supply the deficiency of the other sense.

dered useful; by which the bounds of your humane establishment would be extended, and greater scope given to your highly benevolent views.

I have the honour to be, Gentlemen,
 With great respect,
 Your most obedient humble servant,
 JOHN HARRISON CURTIS.

*To the Chairman of the Committee
 for the Deaf and Dumb.*

In proof of the justice of the author's sentiments in the above letter, and that his zeal for humanity was guided at the same time by professional prudence ; he has only to instance the case of a boy born deaf and dumb, who has attained under his care, the use of hearing and speech, the particulars of this remarkable case will be found detailed in his treatise on the physiology and diseases of the ear, page 90 ; and since this case, he has several others of a similar description which are now in the progress of amendment.

The situation of the ear, we may observe, is more internal, and its powers more concentrated than those of the eye; its nervous expansion is more limited, and the bodies which act upon it are denser, and more solid than those of light; hence the sensations conveyed by it are limited, though more numerous and durable than those of the eye.

The subject then, of the present course of lectures, is to exhibit a view of this important organ of sense, and to examine, first, its anatomical structure, and the connexion of its different parts; next, the physiological functions and *distinct* uses of each *separate* part; and, lastly, to trace with minute attention the various states of derangement, forming disease to which it is occasionally subjected, and their best mode of treatment.

If experience and improved knowledge has shewn how much can be done to rectify the imperfections and diseases of the eye,—the same experience, and the same ardent desire of improvement cannot fail to be equally successful in those of the *ear*.*

* It has excited no little malignity on the part of some of his professional brethren, that the author has increased the subdivisions of surgical science, by selecting the diseases of the ear for the exclusive subject of his practice. He has accordingly been publicly attacked by an anonymous writer, under the signature

But the ear, though the most important of all the senses, has hitherto claimed but little attention from the profession. The diseases of every other

of MEDICUS. But as even this illiberal attack is, at least, a proof Medicus considers his pretensions worthy notice, the substance of that attack he shall here lay before his readers. The objections urged by Medicus against his work, are, from the zeal he has shewn to follow the footsteps of the late Mr. Saunders, and to identify many of his own opinions with his : in doing so, he has done what most of the profession will approve,—to follow the example of a man so meritorious in that line, and to endeavour to improve on his opinions and precepts. Had Mr. Saunders continued his attention to the diseases of the ear, with the same ardour as he did to the eye, he might have carried his success there, to an equal length, with what he did in this more pre-eminent organ: but he stopped short, and what he left undone, it is the duty of others to take up, not losing sight of the previous information and principles he had communicated.

Indeed, the Author has every day reason to be more and more satisfied that diseases of the ear, like diseases of other parts of the body, are curable; and that in a great number of cases, the hearing is *only impaired, not lost*; hence the necessity of a proper and attentive treatment. As a proof also of their conviction of this, and that much benefit may be done in this line of practice, several of the most distinguished of the profession, who were governors of the Charter-house dispensary for the diseases of the ear, under Mr. Saunders, which was given up, are now become subscribers to the present Royal Dispensary, while, during the short time it has been established, there have been upwards of 400 patients admitted into this establishment; a great number of whom have been cured or relieved, and thereby rendered capable of obtaining a livelihood, of which before they were incapable.

This

organ are well understood, together with the modes of repairing their defects; but the imperfections of this sense having been little attended to by the regular profession, the treatment has been, for the most part, confined to the hands of empirics; hence, obscurity and prejudice have prevailed in this branch of practice, and an apathy has taken place on the subject, highly injurious to the interests of society.

It has been unfortunately laid down as a maxim, that the diseases of this organ are incurable. But this opinion has no just foundation; and, in fact, might have been applied with equal propriety to the other organs, on which we daily see such admirable cures performed. Indeed, there can be no doubt, but experience, joined with an ardent desire to improve, will be attended with the same success in this as in every other branch of the medical science.

This is the best reply to Medicus's illiberal and unjustifiable attack, which the author closes by inserting the observations of the editor of that respectable newspaper, 'The Times,' on Medicus's communication to him.

"To Correspondents.—A silly person, who calls himself Medicus, has sent us*an impertinent letter, but which is at the same time perfectly unintelligible. If Medicus can behave better than he writes, he may call at our office, and perhaps we shall then be able to understand him."

The Times, Feb. 4. 1818.

But to such a length has prejudice been carried on this subject, that in cases of deafness in early childhood, where much might have been done, and the misfortune of settled disease in a great measure averted, no attempt has even been made to ascertain the defect, or try the smallest means of relief, under the fallacious, and unfortunate idea for the sufferer, that he will out-grow the disease, or that the organ will acquire an acuteness or increased powers as life advances, which it does not possess at that period.

No opinion deserves more to be condemned, or is more against the interest of society; there are indeed diseases of this nature, but they are of the constitutional class, and depend on a general fault of habit, they are not local, or affections of one part. Thus scrofula or king's evil, as puberty advances, and the system acquires greater tone and firmness from the changes which take place at that period, loses much of its virulence and morbid action, and, therefore, in a certain degree, the constitution may be said, as it acquires strength, to outgrow the disease; but even here it is found that unless medicine lend its aid, numerous victims would be lost, before the salutary time of life or out-growing era did arrive.

This popular prejudice I am endeavouring to combat, may be considered as one cause that impedes the progress of medicine, for it prevents

patients applying to the practitioner on the commencement of a malady,—the idea of nature curing disease in general, though proper to be entertained to a certain length by a professional character, should be opposed as a general opinion, from conveying a want of confidence in a science, which is justly considered as the most useful.

The diseases of the ear, like those of other parts, are often constitutional; and the general treatment of the constitution will therefore influence the malady of the particular part. Thus a certain well known malady in its constitutional form and ultimate stage, attacks the ear, and deafness is produced by this specific cause.

The same course of medicines that removes other constitutional symptoms, has an equal effect on this organ; and if there are no other constitutional symptoms but deafness, then employing internal medicines, according to the regular method observed, will remove this complaint.

If the stomach also is the centre of sympathy to the whole machine, as generally admitted, there is no doubt that the proper attention to it, and that of the bowels will do much to remove diseased action connected with accumulation; hence the antiphlogistic treatment succeeds even in cases of apparent weakness, by rousing and invigorating the action of these primary organs, which is soon extended

to the rest of the system, and a full play given to the circulating and secreting powers.

Various other instances might be adduced, all tending to show that there are different morbid changes of this organ, as well as of the others, which are curable by a general treatment acting upon the constitution, and thus indirectly affecting the part.

Nay, even the most difficult of the whole of this class of diseases, that which is termed *nervous deafness*, may, as we find in its first stage, be arrested in its progress, and thus rendered curable.

Hearing then, in the words of a celebrated French physiologist, may be defined the function intended to acquaint us with the vibratory motions of bodies ; sound, therefore, is to the ear what light is to the eye.

A hollow cavern seems the general structure of the organ of hearing, as best fitted for receiving, and reflecting sound.

So necessary is this cavernous shape of the external ear to the reception of sound, that we are told the celebrated tyrant of Syracuse, Dionysius, caused a cavern to be formed in a rock, corresponding to the shape of the human ear, where he used to confine his state prisoners ; and from the strong vibration, and echoes of the sound, he was enabled to learn the secret conversations they held.

In the different tribes of animals, it is liable to considerable varieties in the appearance, and manner of its formation, and in its appendages.

In man it is more perfect in its structure, than in any other animal; and it is, also, of more importance to him, than to any other of the creation. To enable us to form a proper idea of this, I shall now make some general observations on the varied structure of this organ in different animals, preparatory to directing your attention to its particular form and modification in the human race.

All animals then, as far as we know, possess this sense; it was formerly doubted with respect to fishes. The organ of hearing in fishes, was first discovered by the late Mr. John Hunter, and is prosecuted at considerable length in his work on the organ of hearing in fishes, by the late professor Monro, of Edinburgh. Thus the late researches, and discoveries in comparative anatomy, have sufficiently established their possession of this sense, as well as the other classes.

The impressions the organ of hearing receives, are conveyed through the medium of air, which acquires from the action of the body communicating sound, a tremulous motion or vibration; and as these motions or vibrations succeed each other, sound is impressed or directed to the thin membrane stretched obliquely across the auditory passage, named the tympanum, where it produces a

similar motion, which latter motion carried on, excites a corresponding feeling in the mind.

That sound can only be conveyed through the medium of air, is fully confirmed by the experiments of the diving-bell; for if a sonorous body is placed in it, as a bell for example, in consequence of its being exhausted of air, no sound is produced, nor can the ringing of the bell be heard.

Though *hearing* is more perfect in man than in any other animal, it is not so at the period of birth; an infant hears at first very imperfectly, and only strong sounds; but this arises in part, from the passage or meatus externus being covered with a viscid mucus, or discharge from the ceruminous glands of the ear, in a similar manner as the meconium fills up the intestines: on the removal of this original layer or deposition, the sense soon appears perfect, but not so strong as at an after period of life. Indeed, as we find the meconium, with some children, at birth possesses a morbid viscosity; so in the same manner the secretion most analogous to it will partake of a similar state, and may therefore, be suspected where congenital deafness occurs by examining the state of the first passages, or primæ viæ.

In all animals, the ear is divided into an externa and internal part, and the difference in the structure of the organ of hearing is greater in the external ear than in the internal.

In quadrupeds this difference of structure is more conspicuous than in the rest, and this difference or variety seems intended to adapt the animal the better for its particular circumstances or mode of life.

On examining the external ear in quadrupeds, it is found to resemble the oblique section of a cone, from near the apex to the base. Hares, and other animals exposed to danger, and liable to be attacked by man or beasts of prey, have large ears, and they are particularly directed backwards; while their eyes at the same time, full and prominent, warn them of any danger in front. Rapacious animals, on the contrary, have their ears placed directly forwards, as is observable in the lion, the tiger, the cat, and others. Where the peculiar nature of animals is such as to require that sound be distinctly heard from a low situation, as, for instance, slow hounds and others, they will be found to have either large hanging-down ears, or to have them flexible, since they move their heads with more difficulty than man.

Much advantage may be taken of this circumstance in the construction of mechanical contrivances for assisting hearing; some animals keep their head to the ground, as impressing the sound more strongly on the organ; and in case of deaf persons, such contrivances should be made nearly

of a length to touch the ground, which would give ample compass for the reception and retention of sound.

Fowls, again, differ from quadrupeds in having no external ear; but in place of it there is a tuft of very fine feathers, which covers the passage to the ear: this covering allows the sound to pass easily through; and it also prevents any insects, or external matters which might prove a source of injury, from getting into it.

To fowls an external ear would have been inconvenient, as causing an obstruction in the course of their flight, in passing through thickets, and other nearly impervious places. In the external ear of the fowl, there is situated a liquor to lubricate it, and from its disagreeable quality, to prevent the entrance of insects.

This secretion of the ceruminous glands in man, is of the first consequence to the organ of hearing, and should be always kept in view in judging of its diseases; from the moment these glands are formed, even before birth, their secretion is poured out, and accordingly after birth an accumulation in the ear is a frequent source of deafness till removed; it varies in quantity in different individuals, according to habit of body and other circumstances, in the same manner as happens in the quantity of the other secretions, which in a similar way are influenced by

constitution, mode of life, and a variety of other causes ; it is a very frequent source of deafness, and in all cases should be strictly inquired into.

On examining the different tribes of animals, we find that fish, as already noticed, have a complete organ of hearing, and equally perfect as that of the other classes. The element, also, in which they exist, is proved to be one of the best mediums for the transmission of sound : thus, in the skate, on dissecting the head, we find, placed, at some distance behind the eyes, a bag which contains a fluid, and a soft cretaceous substance ; these are the vestibule and cochlea of this fish, corresponding to similar parts of the internal ear in man. There is, also, distributed upon this bag, a part of the auditory nerve, resembling what is termed the *portio mollis*; or branch of the seventh pair of nerves, in the human subject : they have likewise semicircular canals, a leading part of the internal ear, filled with a fluid which communicates with this bag ; and they have also an external passage, which communicates with this internal part.

In the cod species, instead of this soft cretaceous substance, I have noticed, there is found a hard crustaceous stone ; but there seems no appearance of an external passage, as in the skate.

In prosecuting our inquiries farther, the ear has been discovered in insects ; it lies at

the root of their antennæ, or feelers, and can be distinctly seen in the lobster, and some others of the larger kind.

On the whole, the more we extend our examination of this organ of *hearing*, we shall find it so constructed, in every class, as to be peculiarly adapted to the mode of life, and other circumstances connected with the situation of the animal.

Man has the most perfect external ear of all animals: as he must hear sounds equally from all quarters, and especially such sounds as are transmitted from his own height, so his external ear is both large, and placed in a vertical manner, turned somewhat forward. But to compensate the animal when compared with man, the former in general possesses, in this respect, a greater power of motion, and is furnished with a greater number of muscles. Thus animals can direct or apply the cone of the ear to the sonorous body without moving the head.

When the motion of the external ear takes place in man, which has been known in some rare instances, it does not seem to add any thing to the perfection of the sense, as it does in them.

In describing the human ear, it is divided into three parts, the external ear, the intermediate, and the internal.

The external or outward ear is designed by nature to stand prominent, and to bear its proportion

in the symmetry of the head ; but in Europe it is greatly flattened by the pressure of the dress. It consists of elastic cartilage, formed with different hollows, or sinuosities, all leading into each other, and finally terminating in the concha, or immediate opening into the tube of the ear. This form is admirably adapted for the reception of sound, for collecting and retaining it, that it may not pass off, or be sent too rapidly to the seat of the impression. The intermediate ear displays an irregular cavity, having a membrane stretched across its bottom ; and this cavity has a communication with the external air, through the tube which leads into the fauces. The tympanum, or drum, which stretches across it, is intended to carry the vibrations of the atmosphere, collected by the outer ear, to the chain of bones which form a peculiar mechanism in the tympanum.

The internal ear may be considered as the actual seat of the organ : it consists of a nervous expansion of high sensibility, the sentient extremities of which are spread in every direction, and in the most minute manner, inosculating with each other, and forming plexus, all for the purpose of increasing sensation.

Here also the sound is collected and detained ; which the mastoid cells and cochlea present.

To this apparatus is added the presence of a fluid, contained in sacs and membranes; and as this fluid is in large quantity in some animals, there is no doubt it is intended as an additional means for forcing the impression; and the known influence of water, as a powerful medium, or conductor of sound, strengthens the idea. The internal ear of man, therefore, has all the variety of apparatus which is only partially present in the other classes of creation; and its perfection is best judged of, by considering the variety which the internal ear of other animals exhibits. The internal ear of some animals, we find, consists of little more than a sac of fluid, on which is expanded a small pulp of nerve; according to the situation of this cavity, as it lives in water alone, or is partly exposed to the air, so in the latter it has an external opening with the ear or otherwise.

All terrestrial animals possess an external opening leading to the internal ear. In fowls, the ear is more of a cartilaginous consistence than real bone. Hence any tremulous motion impressed on the air is communicated merely by the spring and elasticity of these cartilaginous parts, which do not require, in order to render the membrane of the ear tight, the same power or action of the muscles. In the internal ear the

semicircular canals appear also very distinct, the same as in man. In all animals the internal ear is composed of a nervous expansion, contained in a hollow or cavity, and assisted in its impression by a sac and fluid also present there.

Hence of all species of deafness, that termed nervous, or which affects the delicate nervous expansion of the ear, is the most serious.

In consequence of the little success that has attended the practice in nervous deafness, I have conceived in such constitutions the quantity of air admitted by the external ear is too great ; and in order to produce an equal balance between it and that admitted by the mouth, or through the passage of the Eustachian tube, I have been induced, lately, to adopt successfully a new mode of practice pursued on the continent, which I shall have occasion to mention in a subsequent part of the course.

Such being the structure necessary to the collection and reception of sound, the latter, it is observed, reaches the ear at equal distances, and in an equal time. The common velocity of sound is at the rate of 1142 feet in a second, or about 13 miles in a minute. The knowledge of the velocity of sound is of great use in determining the distance of objects, at sea ; for if a ship fires a gun, the light of which is seen 20 seconds before the report

is heard, then it is known to be at the distance of 20 times 1142 feet, or about $4\frac{1}{3}$ miles.

All sound is conveyed in waves or vibrations; and where these meet with an obstruction in their course, which is hard and of a regular surface, on striking against it, they become reflected. If the ear be placed in the course of these reflected vibrations, it will perceive a sound similar to the original one, which will appear to proceed from a body situated in the same position and distance as the reflecting medium or obstacle, and exactly as the original sounding body was before.

This sound is properly termed an echo, or a reflecting one, thrown upon the ear by the obstructing body.

Reflected sounds, like reflected rays of light, may be deflected, that is, magnified or turned off, by contrivances similar in principle to those made to increase the powers and extent of vision. Thus, where there is an elliptical cavity, sound uttered in one focus or point of it will be heard much magnified in the other focus; of this a striking example is given by the effect of sound in domes or vaults, as instanced in the Whispering Gallery of St. Paul's Cathedral. It is on this principle the speaking-trumpet is constructed, so useful at sea; which in its form is

a hollow parabolic conoid, having a perforation at the top, to which the ear is applied in hearing, or the mouth in speaking. This principle of reflected sounds applies to the ear itself. From the hard bodies situated in the internal ear the sound is evidently reflected back to the other parts, so that the organ may be said to combine both principles of receiving the impressions directly, and again indirectly, by the reflection of the sounds which strike on its harder or bony parts, thus applied a second time, as it were, to the auditory nerve. This idea is strengthened by the circular shape of the canals, where the sound striking on one focus will be magnified as it extends to the other.

The same may be said in respect to the cochlea, and all the internal parts of the organ, which are certainly formed for this reflection and reverberation of sound. Indeed, it is only by comparing the structure with the parts we know, that a just idea can be formed of the peculiar and intricate fabric we observe, as we cannot suppose any part of the mechanism is made in vain.

Besides the effect of the hard and bony parts of the ear in increasing the power of sound, the tension of the different membranes seems also an essential requisite. Thus various muscles are so situated as to put the parts on the stretch,

that the sound striking upon them, like the parchment of a drum, may, from this tension, have its influence augmented.

In respect to its tension, the tympanum may be also compared, not unaptly, to the strings of a violin, or musical instrument even more properly than to a drum ; and as the state of tension and relaxation we find produce such a variety of sound with this instrument, so in the same manner a variety of circumstances will equally affect the tension and relaxation of this part of the ear, and consequently vary its powers of impression.

Its four bones act mechanically, in consequence of the power of their muscles, which strike like the key of an instrument, and produce a percussion of sound on the tympanum.

The knowledge of reflected sounds has never yet been taken advantage of by the aurist in applying the principle to the construction of artificial means for assisting the faculty of hearing ; the only principle attended to has been, to increase the collection of sounds by extending the canal of the auricle or external ear, in the form of trumpets and cones : but if the farther power of reflected sound were admitted into these instruments, as I have now attempted to do, on the plan of the speaking-trumpet, a two-fold advantage would arise,

both in a greater collection of the vibrations, and in their more powerful and repeated application to the organ*.

Indeed, in constructing such instruments, the length we may observe is the great point; for as in mechanics the powers of the lever are increased by its length, so the strength of the impression conveyed by the air will be in proportion to the length, and also the straitness of the tube through which it is conveyed.

Besides the perfection attached to the structure of the human ear beyond that of other animals, its nervous texture internally is of a more delicate and sensible nature. Thus the nerves are even more acute or sentient than in the other parts of the body. All the nerves of the internal ear display a soft pulpy substance, but are never seen in the form of a firm cord.

The auditory nerve also as it enters the internal passage of the ear; is accompanied by a larger artery than most of the other nerves, to heighten the sensibility; for increased circula-

* Besides this instrument, in order to give every possible assistance to deaf persons, the author has with much pains collected a variety of ingenious mechanical contrivances, from the continent, on the principle of improvement, on some of which he has made important and useful alterations.

tion has every where this effect; and it also forms into plexus, or combinations, for the same purpose.

Though the use of the Eustachian tube has been doubted, as conveying sound by the mouth, yet a simple experiment will convince us, that it has *some* influence in this respect; thus if a deaf person is to converse with another, and a wire or other medium of communication is made to pass to the mouth of each, by placing its extremity between the teeth, the deaf person will hear the conversation better than without this assistance, which certainly proves that part of the vibrations of sound is carried along the wire into the mouth; and applied to the ear, through the Eustachian tube in the throat, while a part also reaches the ear externally, and is collected in the auricle in the usual manner: this fact is farther proved by deafness occurring from the obliteration of the passage of the Eustachian tube, in consequence of diseases in the throat, particularly in consequence of ulcerations from a well known specific cause. Besides, therefore, merely preserving the balance of air between the external and internal ear, it certainly has an influence also in conveying sound; and while the meatus externus admits its application one way, the aperture of the Eustachian tube admits it, we may conclude, in a certain degree, the other,

and may be considered as an accessory means to increase the impression, driving the vibrations of sound in different directions to one point.

Indeed, this opening between the ear and throat is one of great consequence, and one of which much advantage may be taken in the treatment of deafness ; in nervous deafness, I am persuaded, too great a quantity of air, as I have stated, is often admitted to the ear, which appears from the confused noises complained of, when it does not act with sufficient energy to allow the impression to be made. By lessening, therefore, the action of the air on the external passage, and making it pass more forcibly by the internal, I am satisfied, deafness may be often cured.

When we examine next the nervous texture of the internal ear for receiving the impression, nature seems to have provided that the nerves, as I have observed, should be here more acute or sentient than elsewhere.

Nay, they often acquire a morbid acuteness, without disease. This is particularly the case after childbed, and so acutely sensible is the organ in this state, that there are many instances of a sudden noise, producing syncope and immediate death; while in such cases, on dissection, no traces of disease could be discovered, and therefore, that this extreme sensibility was the sole cause.

From the same cause of its acuteness or delicate feelings, its powers are also liable to suspension, and perhaps this is the state of it, in that deafness which often takes place after engagements both by sea and land, when the tremendous noise acting upon it, exhausts and destroys its powers.

On proceeding farther in our examination, the nerves of the tympanum and other parts of the ear, where this exquisite sensibility is *not* so much required, display the natural texture as firm cords, and consequently a less sensible substance. All these circumstances shew that hearing, or the impression of sound to produce it, requires a higher degree of organization than the other senses, and a more complex mechanism.

In order to judge properly of the parts, more essential to the organ, we must take the assistance of the discoveries made by dissection.

With respect to the external ear in man, wherever it is completely removed, either by accident or design, deafness ensues, although its partial removal is not attended with this imperfection. The external ear, therefore, or something in its form to collect sound, is a necessary division of the organ.

When we proceed internally, we find that a partial *destruction* of the membrane of the tympanum, is not accompanied with deafness; but its total removal is always so; this partial destruction is

proved from persons being able to make the smoke of tobacco pass through the throat by confining the mouth and nose, in consequence of its entering the Eustachian tube, and thus going out of the external ear, which could never take place without an opening, or perforation of the membrane of the tympanum.

Ulcerations of the ear in childhood, have frequently this effect of destroying a part of the membrane of the tympanum, and yet the child, as he grows up, continues afterwards to hear without any perceptible inconvenience; yet in order to hear with ease, it seems necessary that the membrane of the tympanum, even though partially destroyed, should always possess a certain degree of tension.

For the membrane of the tympanum may be compared to the parchment of the drum, and is the medium by which sound is impressed on the organ, in the same manner as the beating of the parchment gives action and expression to that instrument.

In proof of this, cases of partial deafness are recorded where persons could only hear when a strong sound, such as that of a drum, was applied to the ear; and on dissection in one case of this kind, related in the French memoirs, no other cause appeared to produce deafness, but a highly-relaxed state of the membrane.

Yet not only may the membrane of the tympanum be partially destroyed, and hearing preserved, but likewise the small bones of the tympanum have been in certain cases lost, or come away from ulceration, from a constitutional or other cause; but in such cases it appears the stapes was *always* left, and thus the openings of the fenestra ovata and rotunda, were preserved, which prevented the escape of sound from the labyrinth and internal parts! Where the stapes is removed by opening the internal ear, deafness must unavoidably ensue.

With respect to the Eustachian tube, its aperture into the throat seems indispensable to hearing, and wherever closed from malconformation or disease, deafness is a certain consequence. I already mentioned its obliteration happening in the throat from a particular disease; which is one strong reason for an early attention to such complaints*; but the same thing is apt to occur from a catarrh or common cold, when it is violent or long continued.

After considering the tympanum and Eustachian tube, I remarked in the internal ear, that the presence also of a fluid appears indispensable to the exercise of hearing. In all dissections of old persons

* The poison of these complaints has a peculiar action on the nervous system, hence when the disease is latent in the habit, there is often a dullness and inaptitude of all the nerves, particularly those employed in the more active organs, to receive impressions.

who have been deaf for years, on examining the internal ear, it has been found totally dry, and wanting its secretion, or that fluid I before mentioned, contained in its sacs and membranes. Such a state occurs frequently from age, yet it may occur from particular circumstances; especially after fevers, of which deafness is often a consequence.

The air, I have endeavoured to shew, is the great medium through which sonorous bodies act on the ear. Its entire exclusion, I have already stated, prevents our hearing sound, however strong; and on the same principle, the condensation of air increases the force of sound in a proportion to the degree of condensation.

Water is likewise an equally effectual medium as air, and a bell rung under water is heard with equal distinctness as in the air; its effect is strongly conspicuous in cases of echos or reflected sounds, for where the sound has to pass over a lake or sheet of water, before it reaches the hard or obstructing body, it is much stronger than in another situation; a famous instance of this is well known to travellers, in the echo of Portici in Italy.

From this general view, then, of the organ, the parts strictly essential to hearing are,—

First. An external ear*; for in man, when—

* The external ear can only be considered as accessory in its functions to the internal; and it was conceived by the Count



ever this part is completely removed, deafness is a consequence.

Secondly. The membrane of the tympanum, which may be partially injured, but never can be completely removed, without producing deafness.

Thirdly. The stapes; for all the small bones of the ear may be removed without causing deafness; but the stapes is the only one that prevents the escape of sound from the internal ear.

Fourthly. The aperture of the Eustachian tube, as preserving the access of air through the throat to the tympanum, and its renewal and change in the organ

de Buffon, that hearing could take place without it. This he considered proved by the instances of dogs, and other animals, from the whim of their owners, being occasionally deprived of the external ear, and suffering no defect by the operation. But though this fact may be true in young animals, and while the expansion of the auditory nerve on the internal ear possesses its full powers and influence to receive the impression of sound, yet it is clear that in the human subject, such a loss would be severely felt; which is confirmed by the advantage of artificial means, in collecting the sound, and strengthening the power of the impression.

Besides, in cutting the external ear in animals, part of the muscles still remains; and by a natural instinct, the animal acts with the remaining part with more energy and applies it more eagerly and forcibly to the sonorous body, than before their partial removal, which entirely condemns Buffon's assertion.

Fifthly. The presence of a fluid in the internal ear, which is necessary to heighten the acuteness of impression, and to render it effectual.

Such, as I have endeavoured to describe it, is the complex and minute structure of this important sense ; and when we attend to the intricacy of its parts, to the delicacy of its texture, and to the numerous windings and sinuosities it every where displays, we are struck with wonder and admiration at the nicety of its mechanism, and cannot be surprised that the least change should produce on it a deviation from the healthy state.

Nay, when we farther contemplate the varied organization of the ear in the different tribes of animals, we shall in all of them find it admirably fitted for their different situations and characters. It is the work of infinite power, and modified by a Supreme Being, who has adapted every creature, whether animate or inanimate, for its place. All our researches in anatomy serve to point out this fact, but none more strongly than the investigation of the different organs of sense. A nervous expansion we find the universal medium, on which the impressions are made, and through which they are conveyed. This being the case, all the senses may be considered in a manner as resembling each other, and only differing in their

peculiar modification, and what may be termed the auxiliary organization of the parts that transmit the effect to the mind.

After this general view then, Gentlemen, we shall now be prepared for entering, at my next lecture, on the anatomy of the human ear, as the foundation of our subject.

END OF THE FIRST LECTURE.

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OF
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